The New Way of Thinking Physical Reality.

(1) *The Philosophy of Humanism and of other Subjects.* By Viscount Haldane. Pp. xiv+302. (London: J. Murray, 1922.) 12*s.* net.

(2) *L'Expérience humaine et la causalité physique.* Par Prof. Leon Brunschvicg. (Bibliothèque de Philosophie Contemporaine.) Pp. xvi+625. (Paris: Félix Alcan, 1922.) 30 frs.

(3) *La Notion d'espace.* Par Prof. D. Nys. (Fondation Universitaire de Belgique.) Pp. 446. (Bruxelles: Robert Sand; London: Oxford University Press, 1922.) 15*s.* net.

(4) *The Evolution of Knowledge.* By George Shann. Pp. vii+100. (London: Longmans, Green and Co., 1922.) 4*s.* 6*d.* net.

THE direction which scientific research has taken in the twentieth century is imposing on philosophy a task the magnitude of which is probably not yet realised by any one. Aristotle, in his doctrine of the four causes and in his discovery of the syllogism, the logical instrument which gave that doctrine the appearance of precision, determined the type and the mode to which all succeeding scientific research right up to modern times has adhered. The essential thing in the Aristotelian doctrine is that the analysis of the physical universe proceeds in precisely the same way as the analysis of the elementary conditions which govern the production of a work of art. There is, that is to say, a matter on which an agent impresses a form in order to express an end or purpose. The modern sciences of biology and psychology had already begun to undermine this æsthetic mode of thinking reality and now the Einstein theory in mathematical physics has swept away its foundations. The result is that once more in human history physics and metaphysics are joined together. The union has been brought about by physical science itself, without any betrayal of its positive and experimental character, by fearless acceptance of the apparently paradoxical results of experiments. It is the outcome, we can now see, of a historical progress of pure science in the last three centuries, continuous in its development from Galileo to Clerk Maxwell, Mach and Einstein, which has led to a complete revolution in the way of thinking physical reality.

The philosophical current of human thought, although always a reflection of the scientific current, has not the same rhythm. It happens at times, unexpectedly and as if by a sudden explosion, that the scientific current is interrupted; some wholly unlooked-for results of experimental investigation have occurred, and the human mind has sprung at once to the general principles whence those results proceed. A new vision of truth then opens out before human consciousness involving its whole conception of the universe and mind. It was such a vision which produced the new birth of modern philosophy in the seventeenth century. To-day a new and most startling discovery, following indeed a long historical development, but a development we can appreciate only now because the discovery has given us the vantage ground from which to look back on the history, is opening to us a new vision of truth and making us rethink our whole concept of the nature of physical reality.

(1) and (2) It is this new way of thinking physical reality which, each in his own way, the authors we have grouped together are seeking to express. In the case of Lord Haldane's "Humanism" and Prof. Brunschvicg's "L'Expérience humaine" there is full consciousness of it and a direct purpose of exposition. It is noteworthy that two such books, widely different in their method and scope and yet so singularly in agreement, both in their viewpoint and aim, should appear together. Lord Haldane, who is not a mathematician, devotes himself to detailed philosophical analysis of the new mathematical concept, while Prof. Brunschvicg, a mathematician of distinction and known to us chiefly by his *editio princeps* of Pascal's works, traces with an extraordinary grasp of details the historical development of the concept of physical causality which has resulted in the generalised theory of relativity; and both interpret to us the new concept of the physical universe in practically identical terms. The humanism of the one is the human experience of the other, and Lord Haldane's "foundational nature of knowledge" is Prof. Brunschvicg's "philosophie de la pensée."

The cosmology of Einstein differs fundamentally from every previous doctrine inasmuch as it discards both the factors which in the long history of human thought have contended against one another for pre-eminence. It regards neither the definition of the concept, whence deduction is made, nor the datum of experience, on which induction is based, as fundamental. Einstein's world is a world of figures, supposing neither *a priori* concepts nor sensible images. These figures, however, are not fictions, they are not even abstractions, they correspond to coefficients which reality furnishes. Mathematics determines for us the *invariant* which passes from one system to another.

Between Newton and Einstein, Prof. Brunschvicg tells us, there is this difference that according to Newton the thing to be measured has an absolute content, inaccessible it may be directly to man, but certainly accessible to God. That is to say, the Newtonian

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universe would be an object of intuition, that is, would form a picture, at least to God. According to Einstein, we cannot say, speaking absolutely, that there is any picture even for God. The picture is only known as a function of the frame. That is, the things measured are only known through the measurings, and the measurings are bound up with the things they serve to measure. The understanding of this reciprocity makes it impossible to separate and consider apart what, for the convenience of language alone, we distinguish as frame and picture. Science goes in a kind of perpetual oscillation, with an ever-narrowing adaptation, from the measured to the measuring, from the measuring to the measured. Thus, considered from the point of view of the measuring, it is impossible by any physical means whatever to reveal a uniform movement of translation in which both the observer and all that he observes participate. Considered from the point of view of the measured, the velocity of light is the only velocity which is unchanged when we pass from one system of reference to another, and in the electromagnetic universe this velocity plays the rôle which infinite velocity formerly played in the mechanistic universe. The constancy of the velocity of light implies further an irreducible plurality of physical measurements of times, because the various groups of observers cannot make clocks from which they can detach themselves and compare them as instruments with one another. They are themselves the inhabitants of a clock, prisoners in their own time-measuring instrument, bound to its state whether they suppose it at rest or moving.

To most of us, however, whether our interest in the principle of relativity is scientific or philosophical, the greatest stumbling-block is probably the hypothesis of a finite universe. This seems a contradiction in thought and at least an unnecessary appendage of the principle. Prof. Brunschvicg shows us very clearly why the equations lead necessarily to this hypothesis, for they allow us to show that without it the total reduction of inertia to reciprocal action between masses is impossible

The metaphysics which the new physics implies means therefore a complete revolution both in philosophy and science. As metaphysics it claims neither priority over science nor independence of it, not even the independence implied by Kant in the theory that the conditions of experience are *a priori*. This is not because metaphysics has learnt to be humble or to be resigned, but because in reality there is a contradiction in the very notion that by reflecting on science we can disengage certain antecedent conditions capable of enclosing all past and future knowledge in static schemes. On the side of positive science we have come to see that by the pure experimental method we are not and cannot be brought into contact with elemental constituents of experience, whether material as Democritus conceived them, or intelligible as Plato conceived them, or sensible as Hume conceived them. The realities we are dealing with in physical science are statistical, so that all reflection on the results of experiment is, not an approach to the absolute, but a progress in the discovery of relativity. The early nineteenth-century ideal of a pure positive science perpetually progressive by means of a division of labour has given place in the twentieth century to a new and more subtle idea, the idea of a progress which is reflective.

(3) Prof. D. Nys's "La Notion d'espace" is a valuable book, but belongs to a different category from that of the two works we have mentioned. It is the fourth volume of his "Cosmologie ou Étude philosophique du monde inorganique," and is encyclopædic in its treatment of the subject. It includes in a general view of the various philosophical doctrines a very clear account of the recent theories with the criticisms upon them and is a model of careful compilation. It develops no original theory and is written from the point of view of neo-scholasticism.

(4) Mr. Shann's short treatise on "The Evolution of Knowledge" is the work of one who knows how to think out a problem for himself. It deals with a different aspect of relativity from that of the physical principle, namely, with the nature of the vital need which has produced in man and some animals the function of knowing. All those friends of Mr. Shann who have received from him from time to time his excellent privately printed pamphlets, bound in the well-known scarlet wrapper, will welcome this published work.

H. WILDON CARR.

Ceremonial Exchange.

Argonauts of the Western Pacific: An Account of Native Enterprise and Adventure in the Archipelagoes of Melanesian New Guinea. By Dr. Bronislaw Malinowski. Pp. xxxii + 527. (London: G. Routledge and Sons, Ltd., 1922.) 21*s*. net.

IN this volume Dr. Malinowski has given the first-fruits of his extended stay in the Trobriands, a group of islands off the south-east of New Guinea. A good deal of more or less desultory information, published in Government reports and elsewhere, has indicated that these islanders differ in some respects from their neighbours; Dr. Malinowski now shows how intimately they are all associated with one another, not merely by ordinary trade, but by a hitherto unrecorded and very remarkable system of ceremonial

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